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CURRICULUM PROPOSAL COVER SHEET
University-Wide Undergraduate Curriculum Committee

I. CONTACT

Contact Person Dennis Whitson and W. Larry Freeman Phone 7-4593/4592

Department Physics

II. PROPOSAL TYPE (Check All Appropriate Lines)

X **COURSE** Comp Interfac in E-O
Suggested 20 character title

X New Course* EOPT 105 Computer Interfacing in Electro-Optics
Course Number and Full Title

____ Course Revision _____
Course Number and Full Title

____ Liberal Studies Approval+ for new or existing course _____
Course Number and Full Title

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____ Course Deletion _____
Course Number and Full Title

____ Number and/or Title Change _____
Old Number and/or Full Old Title

_____
New Number and/or Full New Title

____ Course or Catalog Description Change _____
Course Number and Full Title

PROGRAM: ____ Major ____ Minor ____ Track

____ New Program* _____
Program Name

____ Program Revision* _____
Program Name

____ Program Deletion* _____
Program Name

____ Title Change _____
Old Program Name

_____
New Program Name

III. Approvals (signatures and date)

Kenneth E. Hershman 11/16/00
Department Curriculum Committee

Richard D. Roberts 11/16/00
Department Chair

College Curriculum Committee 01/12/01

John D. Eck 1/12/01
College Dean

+Director of Liberal Studies (where applicable)

1/15/01
*Provost (where applicable)

1993

Syllabus of Record for EOPT 105

I. Catalog Description

EOPT 105 Computer Interfacing in Electro-Optics

2 lecture hours
3 lab hours
3 credits
(2c-3l-3sh)

This course is designed to teach the fundamentals of interfacing the personal computer to its physical surroundings such as electro-optics equipment. The students will do graphical programming and learn how to use virtual instruments in order to collect data and to control experiments. The students will use a program that employs graphical block diagrams that compile into machine code. This course includes a lab component.

II. Course Objectives

Upon successful completion of this course, the student will be able to

1. Describe and apply the basic concepts of computer interfacing.

2. Apply graphical programming using a program like LabVIEW.

3. Use virtual instruments.

4. Position mechanical objects through the use of stepping motors.

5. Collect analog signals and store the results in digital memory through the utilization of the Analog to Digital Conversion (ADC) function.

6. Use the Digital to Analog Conversion (DAC) function to drive outside experiments with an analog signal.

7. Use counter/timers.

8. Describe how to interface the computer to electro-optics equipment in order to collect data and to control the equipment.

III-A. Course Outline for Lectures (28 hrs)

A. Introduction (1 hr)
   1. Graphical Programming
   2. Virtual Instruments (VI's)
   3. Measurement
   4. Control

5. Front Panel and Block Diagram

B. Digital Interfacing. (2 hrs)
   1. LabVIEW Virtual Instruments (VI's) for Digital Interfacing
   2. Binary and Hexadecimal numbers.
   3. Interfacing diodes and a seven-segment readout.
   4. Control a stepper motor with digital input.

C. Digital to Analog Conversion (DAC). (2.5 hrs)
   1. Theory
   2. LabVIEW VI's for DAC

D. Analog to Digital Conversion (ADC). (2.5 hrs)
   1. Theory
   2. LabVIEW VI's for ADC

E. Charts and Graphs (1 hr)

F. Waveform Generation (1 hr)
   1. Theory
   2. LabVIEW VI's for Waveform Generation

G. Counters and Timers (1 hr)
   1. Theory
   2. LabVIEW VI's for Counters and Timers

H. Controlling Program Execution with Structures (3 hrs)
   1. The For Loop
   2. The While Loop
   3. Case Structures
   4. Sequencing Structures

I. Arrays and Clusters (2 hrs)

J. Strings and File I/O (2 hrs)

K. Data Acquisition and Signal conditioning (3 hrs)
   1. Single and Multiple Channel Analog Input/Output
   2. Differential and Single-Ended Inputs
   3. Amplification and Linearization
   4. Thermocouples
      a. Cold-Junction Compensation
   5. Resistive Thermal Detectors (RTD)
      a. Current Excitation
      b. 4-Wire and 3-Wire Configuration
   6. Strain Gauges

a. Voltage Excitation
b. Bridge Configuration
7. Position Indicators
8. Accelerometers

L. Computer control of electro-optics equipment. (2 hrs)
1. Serial communication.
2. Parallel communication.

M. Data acquisition and control using the computer with electro-optics equipment. (3 hrs)

Testing (2 hrs)

III-B. Course Outline for Labs (14 labs, 3 hours per lab)

A. Introduction (1 lab)
1. Lab Safety
2. Lab Practice
3. Technical Writing
a. Notebooks
b. Lab Reports
4. Rules and Regulations

B. Digital Interfacing. (1 lab)
1. Turn diodes on and off and display characters on a seven-segment readout.
2. Control a stepper motor with digital input.

C. Digital to Analog Conversion (DAC). (1 lab)

D. Analog to Digital Conversion (ADC). (1 lab)

E. Waveform Generation (1 lab)

F. Using a Counter, output a square wave whose period is dependent on the number in the register. (1 lab)

G. Set up a VI (Virtual Instrument) to Take the Square Root of a Number. (1 lab)

H. Drive a Resistor Capacitor (RC) circuit with the DAC output and collect the output data at one of the ADC's and put the data into a spreadsheet. (1.5 labs)
1. Display the Data in a Graph in the front panel.
2. Display the Data in the spreadsheet using a standard plotting package.

I. Data Acquisition and Signal conditioning (1.5 labs)
   1. Measure the Temperature Using a Thermocouple
   2. Measure the Temperature Using a Resistive Thermal Detector (RTD)
   3. Measure Strain using a Strain Gauge
   4. Measure Position using a Position Indicator
   5. Measure Acceleration using an Accelerometer

J. Use the computer to control some electro-optics equipment. (1.5 labs)

K. Use the computer to do some data acquisition with electro-optics equipment. (1.5 labs)

L. Lab Practical: Students will be required to set up some experimental equipment and take and analyze some data. (1 lab)

IV. Evaluation Methods

The final grade for the course will be determined as follows:

4% Problem assignments dealing with binary, decimal, and hexadecimal number systems.

48% Using LabVIEW to construct programs to interface between the computer and experiments outside of the computer. The labs will be demonstrated to the instructor to show that they work.

48% Tests. Three tests (two during the semester and a final) consisting of both writing programs with open book and answering questions with closed book.

Grading Scale:
90-100% : A; 80-89% : B; 70-79%: C; 60-69% : D; below 60% F.

Attendance Policy: The attendance policy will conform to the University wide attendance criteria.

V. Required textbooks

Beyon, Jeffry Y., *Hands-On Exercise Manual for LabVIEW Programming, Data Acquisition, and Analysis*, Prentice Hall, 2000

VI. Special resource requirements

None

VII. Bibliography

Beyon, Jeffry Y., *LabVIEW Programming, Data Acquisition, and Analysis,* Prentice Hall, 2000

Bishop, Bob, *Learning with LabVIEW 6i,* Prentice Hall, 2000

Bitter, Rick, *LabVIEW Advanced Programming Techniques*, CRC Press, 2000

Buckman, A. Bruce, *Computer-Based Electronic Measurement: An Introductory Electronics Laboratory Workbook based on LabVIEW and Virtual Bench*, Prentice Hall, 1999.

Johnson, Gary, *LabVIEW Graphical Programming: Practical Applications in Instrumentation and Control*, McGraw Hill, 1997

The Measurement and Automation Catalog 2000, National Instruments, Austin, Texas, 2000

Paton, Barry E., *Sensors, Transducers and LabVIEW*, Prentice Hall, 1998

Rahman, J., *LabVIEW Applications and Solutions*, Prentice Hall, 1999

Travis, Jeffrey, *LabVIEW Internet Applications*, Prentice Hall, 2000

Wells, L., Travis, J., *LabVIEW for Everyone, Graphical Programming Made Even Easier*, Prentice Hall PTR, 1997.

Course analysis Questionnaire
EOPT 105, Computer Interfacing

Section A: Details of the Course

A1 This course is a requirement for the proposed degrees Associate in Applied Science in Electro-Optics (A.A.S.E.O.) and Associate in Science in Electro-Optics (A.S.E.O.). This course is not intended for inclusion in the Liberal Studies program.

A2 This course does not require changes in any other courses in the department. The Applied Physics program will have an additional track associated with the A.S.E.O. degree and this course will be part of that track.

A3 This course has not been offered on a trial basis at IUP.

A4 This course is not intended to be dual level.

A5 This course is not to be taken for variable credit.

A6 Similar courses are offered at these institutions:

1. Central Carolina Community College; Lillington, North Carolina
   LEO 221 PC Interface
2. Northcentral Technical College; Wausau, Wisconsin
   605-132 Computer Interfacing and Instrumentation
3. Springfield Technical Community College; Springfield, Massachusetts
   ET 226 Computer Applications
4. Three Rivers Community / Technical College; Norwich, Connecticut
   CSC 1175 Computer Applications
5. Vincennes University; Vincennes, Indiana
   TMT 120 Computers for Technology

A7 As far as I know, the contents or skills of this proposed course are not recommended or required by a professional society, accrediting authority, law or other external agency. The content and/or skills of this course cannot be incorporated into an existing course. Some of the material is covered in PHYS 355/555 but this course, EOPT 105, expands the use of LabVIEW and does not use C++ to write drivers for the DAQ board. Also this course has applications to electro-optics equipment and PHYS 355/555 does not.

Section B: Interdisciplinary Implications

B1 This course will be taught by one instructor.

B2 This course does not overlap with any course offered by any other department at the University. The Computer Science Department supports the development of EOPT 105, Computer Interfacing in Electro-Optics, (see attached letter from the Chair of Computer Science).

B3 Seats will be available in this course for students in the School of Continuing Education.

Section C: Implementation

C1 The faculty resources are not adequate. In order to teach this course we need 0.208 FTE additional faculty. (For the source of this faculty resource see pg. 23 of "SSHE Requirements for New Programs".)

C2 Other Resources

a. Space
It is anticipated that a new building will be constructed at the North Pointe (Slate Lick) site before this program starts in the Fall of 2002. This building will house the Electro-Optics program. If the building is not ready by Fall of 2002 the program will be housed in the Electro-Optics Center (EOC) located in the West Hills.

b. Equipment
In order to implement this course, we will need approximately $30,000 for hardware and software about 6 months before classes start. The lead-time is necessary because of the time it takes to order and receive equipment; also the labs have to be tried out and the bugs worked out before classes start.

c. Laboratory Supplies and other Consumable Goods
About $2000 approximately 6 months before classes start and about $2000 per year after that.

d. Library Materials
About $500 in years 0 and 1 and about $100 in the following years..

e. Travel Funds
None anticipated

C3 No grant funds are associated with the maintenance of this course.

C4 This course will be offered once a year, usually in the FALL semester.

C5 One section of this course will be offered at a time.

C6 Twenty-four students will be accommodated in this course. The nature of the lab activities restricts enrollment to this number.

C7 There is no professional society that recommends enrollment limits or parameters for a course of this nature.

Section D: Miscellaneous

No additional information is necessary.

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November 14, 2000

Dr. Dennis Whitson
Physics Department
IUP

Dear Dr. Whitson:

The Computer Science Department supports the two new degrees being developed by the Physics Department, Associate of Science (A.S.) and Associate in Applied Science (A.A.S.) in Electro-Optics at the IUP Armstrong Branch Campus. The Computer Science Department will support teaching the courses COSC 101, Microbased Computer Literacy, and COSC 201, Internet and Multimedia, at the branch campus. The Computer Science Department also supports the development of the course EOPT 105, Computer Interfacing.

Sincerely Yours

Gary Buterbaugh

Dr. Gary Buterbaugh
Chair, Computer Science Department